



(11) Publication number:

**0 383 091
A1**

(12)

EUROPEAN PATENT APPLICATION

(21) Application number: 90101858.0

(51) Int. Cl.⁵: **C07D 213/61, A01N 47/44,
C07D 333/28**

(22) Date of filing: 31.01.90

(30) Priority: 13.02.89 JP 31145/89

(43) Date of publication of application:
22.08.90 Bulletin 90/34

(84) Designated Contracting States:
BE CH DE DK ES FR GB GR IT LI NL SE

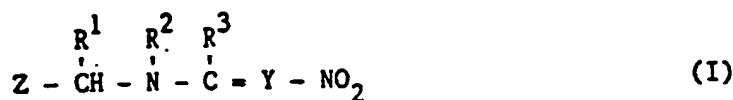
(71) Applicant: **NIHON TOKUSHU NOYAKU SEIZO
K.K.
7-1 Nihonbashi Honcho 2-chome, Chuo-ku
Tokyo 103(JP)**

(72) Inventor: **Shiokawa, Kozo
2-23-30, Shukugawara, Tama-ku
Kawasaki-shi, Kanagawa-ken(JP)
Inventor: Tsuboi, Shinichi
3-26-1, Hirayama
Hino-shi, Tokyo(JP)
Inventor: Moriya, Koichi
39-15 Namiki-Sho
Hachioji-shi, Tokyo(JP)
Inventor: Hattori, Yumi
598, Kobiki-machi
Hachioji-shi, Tokyo(JP)
Inventor: Honda, Ikuro
3-17-7, Minami-machi
Tanashi-shi, Tokyo(JP)
Inventor: Shibuya, Katsuhiko
39-15, Namiki-cho
Hachioji-shi, Tokyo(JP)**

(74) Representative: **Ernst, Hilmar, Dr. et al
Bayer AG Konzernverwaltung RP
Patentabteilung
D-5090 Leverkusen 1, Bayerwerk(DE)**

(54) Insecticidally active nitro compounds.

(57) Novel nitro compounds of the formula (I)



and the use of the new compounds as insecticides.

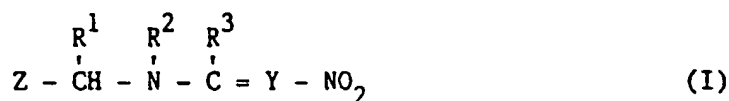
EP 0 383 091 A1

Insecticidally active nitro compounds

The present invention relates to novel nitro compounds, to processes for their preparation and to their use as insecticides.

It has already been disclosed that a certain group of 2-nitro-1,1-ethenediamines is useful as medicaments which influence the circulation, in particular as hypotensive agents (see the U.S. Patent 4,567,188), a certain group of N-cyanoisothioureas is useful as medicaments for treating ulcers (see Japanese Patent Laid-open No. 234,064/1987), the N-cyanoisothioureas disclosed in the above Japanese patent application have also a function for controlling insects and plant-destructive nematodes (see Japanese Patent Laid-open No. 233,903 and EP-A 303,570), and that a certain group of α -unsaturated amines has insecticidal/miticidal activity (see EP-A 0302389).

There have now been found novel nitro compounds of the formula (I)



wherein R¹ is hydrogen, cyano or C₁₋₄ alkyl,

R² is hydrogen, C₁₋₆ alkyl, C₃₋₄ alkenyl, C₃₋₄ alkynyl, C₃₋₈ cycloalkyl optionally substituted by C₁₋₂ alkyl, optionally substituted phenyl, optionally substituted benzyl, C₁₋₄ alkoxy or -(CH₂)_n-Z, in which n is 1 or 2 and

Z has the same meaning as stated hereinafter,

R³ is -O-R⁴, -S-R⁴ or



in which R⁴ is C₁₋₆ alkyl, C₃₋₄ alkenyl, C₃₋₄ alkynyl, C₃₋₈ cycloalkyl, optionally substituted benzyl or -(CH₂)_n-Z, in which n has the same meanings as stated above and Z has the same meanings as stated hereinafter,

R⁵ and R⁶ are the same or different and stand for hydrogen, C₁₋₉ alkyl optionally substituted by at least one substituent selected from the group consisting of mercapto, C₁₋₂ alkoxy, C₃₋₆ cycloalkyl, amino, C₁₋₂ mono-alkylamino, C₂₋₄ (in total) dialkylamino, C₁₋₂ alkoxy-carbonyl and cyano; or

R⁵ and R⁶ are the same or different and stand for C₃₋₄ alkenyl optionally substituted by halogen, C₃₋₄ alkynyl, optionally substituted phenyl, optionally substituted benzyl, C₁₋₄ alkoxy, hydroxy, formyl, C₁₋₄ alkylamino, C₂₋₄ (in total) dialkylamino, amino, acyl, 5- or 6-membered heterocyclic group optionally substituted by halogen or C₁₋₄ alkyl, or

-CH₂-Z in which Z has the same meanings as stated hereinafter, or R⁵ and R⁶ may form, together with the adjacent nitrogen atom, a 3 to 7 membered cyclic group which may be substituted by C₁₋₂ alkyl and may have N, O or S atom as said ring member, besides the adjacent nitrogen atom,

Y is CH or N, and

Z is an optionally substituted 5- or 6-membered heterocyclic group which has at least one hetero atom selected from N, O and S and which may be benzo-fused, provided that where Y is CH,

then R¹ is cyano or C₁₋₄ alkyl, and with the exception of the case where R¹ and R² are hydrogen or C₁₋₄ alkyl, R³ is -S-R⁴ or



in which R⁴ is C₁₋₄ alkyl, R⁵ and R⁶ are hydrogen or C₁₋₄ alkyl, Y is CH or N, and Z is 5- or 6-membered heterocyclic group having at least one nitrogen atom which may be substituted by halogen or C₁₋₄ alkyl.

The compounds of the formula (I) can be obtained by a process in which

a): (in the case where R^3 is $-S-R^4$ and Y is CH, then R^1 is replaced by R^7 , in which R^7 is cyano or C_{1-4} alkyl)
compounds of the formula (II)

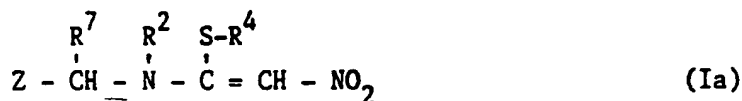


wherein R^4 has the same meaning as mentioned above,
are reacted with compounds of the formula (III)



wherein R^7 , R^2 and Z have the same meanings as stated above,
in the presence of inert solvents,
or

b): (in the case where R^3 is $\overset{\overset{R^5}{|}}{\text{N}} - R^6$ and Y is CH,
then R^1 is replaced by R^7)



wherein R^7 , R^2 , R^4 and Z have the same meanings as mentioned above,
are reacted with compounds of the formula (IV)



wherein R^5 and R^6 have the same meanings as mentioned above,
in the presence of inert solvents,
or

c): (in the case where R^3 is $\overset{\overset{R^5}{|}}{\text{N}} - R^6$ and Y is CH)
compounds of the formula (V)



wherein R^4 , R^5 and R^6 have the same meanings as mentioned above,
are reacted with the aforementioned compounds of the formula (III) in the presence of inert solvents.

or

d): (in the case where R^3 is $-S-R^4$ and Y is N)
compounds of the formula (VI)

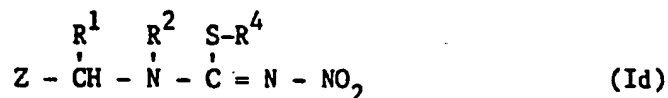


wherein R^2 and R^4 have the same meanings as mentioned above,
are reacted with compounds of the formula (VII)



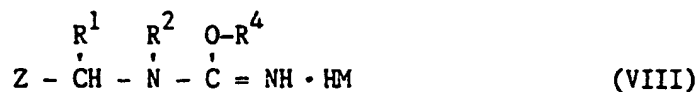
wherein R^1 and Z have the same meanings as mentioned above,
and M is halogen, methanesulfonyloxy or tosyloxy,
in the presence of inert solvents, and if appropriate in the presence of acid binders.
or

e): (in the case where R^3 is $-\overset{\overset{R^5}{|}}{N}-R^6$ and Y is N)
compounds of the formula (Id)



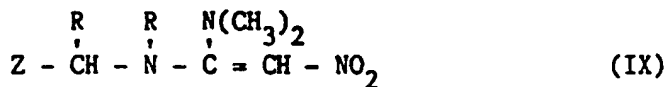
wherein R^1 , R^2 , R^4 and Z have the same meanings as mentioned above,
are reacted with the aforementioned compounds of the formula (IV) in the presence of inert solvents,
or

f): (in the case where R^3 is $-O-R^4$ and Y is N)
compounds of the formula (VIII)



wherein R^1 , R^2 , R^4 , Z and M have the same meanings as mentioned above,
are reacted with fuming nitric acid in the presence of concentrated sulfuric acid, and if appropriate in the
presence of inert solvents,

or
g): (in the case where R^3 is $-O-R^4$ and Y is CH, then R^1 is replaced by R^7)
compounds of the formula (IX)



wherein R^7 , R^2 and Z have the same meanings as mentioned above,

are reacted with compounds of the formula (X)

$R^4 - OH$ (X)

wherein R^4 has the same meaning as mentioned above, in the presence of inert solvents.

5 The novel nitro compounds exhibit powerful insecticidal properties.

Surprisingly, the nitro compounds according to the invention exhibit a substantially greater insecticidal action than those known from the above cited prior arts.

10 In the formulae, alkyl or the alkyl parts of the mentioned radicals are straight-chain or branched, and where the alkyl contains 1 to 9 carbons, then it contains preferably 1 to 6, particularly preferred 1 to 4, and where the alkyl contains 1 to 6 carbons, then it contains preferably 1 to 4, particularly preferred 1 to 3, and where the alkyl contains 1 to 4, then it contains preferably 1 to 3, particularly preferred 1 to 2 carbon atoms. As examples there may be mentioned: methyl, ethyl, n- and i-propyl-, n-, i-, s- and t-butyl, n-pentyl, n-hexyl, n-octyl and n-nonyl.

15 In the formulae, C_3-4 alkenyl is 1-propenyl, allyl and 1-, 2- and 3-butenyl. Preferred and also particularly preferred is allyl.

In the formulae, C_3-4 alkynyl is 1-propynyl, propargyl, 1-butyne-1-yl and 2-butyne-1-yl. Preferred and also particularly preferred is propargyl.

In the formulae, C_3-8 cycloalkyl contains preferably 3 to 6, particularly preferred cyclohexyl, and C_3-6 cycloalkyl is preferably cyclohexyl, and also particularly preferred cyclohexyl.

20 In the formulae, halogen denotes fluorine, chlorine, bromine and iodine, preferably fluorine, chlorine and bromine, particularly fluorine and chlorine.

In the formulae, phenyl and benzyl described as being optionally substituted may contain one or more identical or different substituents. As preferred substituents there may be mentioned halogen such as fluorine, chlorine and bromine, preferably chlorine.

25 In the formulae, 3 to 7 membered cyclic group is preferably 3 to 6 membered cyclic group, particularly preferred pyrrolidino, piperidino, 2-methylpiperidino, morpholino, piperazino or 1-isoxazolyl.

In the formulae, C_2-4 (intotal) dialkylamino is preferably and also particularly preferred dimethylamino.

30 In the formulae, 5- or 6-membered heterocyclic group described as being optionally substituted may contain one or more identical or different substituents such as halogen or C_1-4 alkyl optionally substituted by halogen. As examples there may be mentioned: fluorine, chlorine, bromine, iodoine, trifluoromethyl, methyl, ethyl, n- and i-propyl, and n-, i-, s- and t-butyl. Preferred and also particularly preferred are chlorine or methyl.

The substituent may be in all possible positions of the 5- or 6-membered heterocyclic group. Preferably and also more preferably it is in the 6 position of the 3-pyridyl ring and in the 2 position of the 5-thiazolyl ring.

35 In the formulae, 5- or 6-membered heterocyclic group contains preferably one or two nitrogen atoms, or one nitrogen atom and either one oxygen atom or one sulfur atom, and said heterocyclic group may be benzo-fused. As preferred examples there may be mentioned: 3-pyridyl, 5-thiazolyl, 5-isoxazolyl, 1,2,5-thiadiazol-3-yl, 4-pyrazolyl, 5-oxazolyl, 5-pyrimidinyl, and 2-pyrazinyl.

40 Among the nitro compounds according to the invention, of the formula (I), preferred compounds are those in which

R^1 is hydrogen, methyl, ethyl or n-propyl,

R^2 is hydrogen, C_1-4 alkyl, allyl, propargyl,

45 C_5-6 cycloalkyl optionally substituted by methyl, phenyl optionally substituted by halogen, benzyl optionally substituted by halogen,

C_1-3 alkoxy or $-CH_2-Z^1$ in which

Z^1 is pyridyl optionally substituted by halogen,

R^3 is $-O-R^4$, $-S-R^4$ or



55 in which R^4 is C_1-4 alkyl, allyl, C_3-6 cycloalkyl, phenyl optionally substituted by halogen, benzyl optionally substituted by halogen or $-CH_2-Z^1$ in which Z^1 has the same meaning as stated above,

R^5 and R^6 are hydrogen, C_1-6 alkyl optionally substituted by at least one substituent selected from a group consisting of mercapto methoxy, cyclohexyl, amino, methylamino, dimethylamino, methoxycarbonyl and

cyano, allyl optionally substituted by chlorine, propargyl, phenyl optionally substituted by chlorine, benzyl optionally substituted by chlorine, C₁₋₃ alkoxy, hydroxy, formyl, C₁₋₃ alkylamino, dimethylamino, amino, acetyl, benzoyl, 6-chloronicotinoyl, pyridyl optionally substituted by chlorine or methyl, or -CH₂-Z² in which Z² represents the definition of Z¹ hereinbefore and 5-thiazolyl optionally substituted by chlorine, in addition R⁵ and R⁶ may form, together with the adjacent nitrogen atom, 3 to 6 membered cyclic group which may be substituted by methyl and may have N, O or S atom as said ring member, besides the adjacent nitrogen atom, Y is CH or N, and Z is 5-membered heterocyclic group which has one or two nitrogen atoms, or one nitrogen atom and either one oxygen atom or one sulfur atom and may be substituted by halogen or C₁₋₄ alkyl, or 6-membered heterocyclic groups which has one or two nitrogen atoms and may be substituted by halogen or C₁₋₄ alkyl optionally substituted by halogen and said 5- and 6-membered heterocyclic groups may be benzo-fused, provided that where Y is CH, then R¹ is methyl, ethyl or n-propyl, and with the exception of the case where R¹ is hydrogen, methyl, ethyl or n-propyl, R² is hydrogen or C₁₋₄ alkyl, R³ is -S-R⁴ or



in which R⁴ is C₁₋₄ alkyl, R⁵ and R⁶ are hydrogen or C₁₋₄ alkyl, Y is CH or N, and Z is 5- or 6-membered heterocyclic group having at least one nitrogen atom which may be substituted by halogen or C₁₋₄ alkyl optionally substituted by halogen.

More preferred nitro compounds of the formula (I) are those in which

R¹ is hydrogen, methyl or ethyl, R² is hydrogen, methyl, ethyl, n-propyl, allyl, propargyl, cyclohexyl, phenyl optionally substituted by chlorine, benzyl optionally substituted by chlorine, C₁₋₂ alkoxy or 2-chloro-5-pyridylmethyl, R³ is



in which R⁵ and R⁶ are hydrogen, C₁₋₄ alkyl optionally substituted by at least one substituent selected from a group consisting of mercapto, methoxy, cyclohexyl, amino, methylamino, dimethylamino, methoxycarbonyl and cyano, allyl optionally substituted by chlorine, benzyl optionally substituted by chlorine, C₁₋₂ alkoxy, hydroxy, formyl, C₁₋₂ alkylamino, dimethylamino, amino, acetyl, benzoyl, 6-chloronicotinoyl, 2-chloro-5-pyridyl, 2-chloro-5-pyridylmethyl or 2-chloro-5-thiazolylmethyl, in addition R⁵ and R⁶ may represent, together with the adjacent nitrogen atom, pyrrolidino, piperidino, 2-methylpiperidino, morpholino, piperazino or 1-isoxazolyl,

Y is CH or N, and

Z is 5-membered heterocyclic group which has one or two nitrogen atoms, or one nitrogen atom and either one oxygen atom or one sulfur atom and may be substituted by halogen or C₁₋₂ alkyl optionally substituted by fluorine, or 6-membered heterocyclic group which has one or two nitrogen atoms and may be substituted by halogen or C₁₋₂ alkyl optionally substituted by fluorine, provided that where Y is CH, then R¹ is methyl or ethyl, and

with the exception of the case where R¹ is hydrogen, methyl or ethyl,

R² is hydrogen, methyl, ethyl or n-propyl,

R³ is



in which R⁵ and R⁶ are hydrogen or C₁₋₄ alkyl, Y is CH or N, and Z is 5- or 6-membered heterocyclic group having at least one nitrogen atom which may be substituted by halogen or C₁₋₂ alkyl optionally substituted by fluorine.

Much more preferred nitro compounds of the formula (I) are those in which

R¹ is hydrogen, methyl or ethyl,

R² is hydrogen, methyl, ethyl, n-propyl, allyl, propargyl, cyclohexyl, phenyl optionally substituted by chlorine, benzyl optionally substituted by chlorine, C₁₋₂alkoxy or 2-chloro-5-pyridylmethyl,

5 R³ is



10

in which R⁵ and R⁶ are hydrogen, C₁₋₄ alkyl optionally substituted by at least one substituent selected from a group consisting of mercapto, methoxy, cyclohexyl, amino, methylamino, dimethylamino, methoxycarbonyl and cyano, allyl optionally substituted by chlorine, benzyl optionally substituted by chlorine, C₁₋₂ alkoxy, hydroxy, formyl, C₁₋₂ alkylamino, dimethylamino, amino, acetyl, benzoyl, 6-chloronicotinoyl, 2-chloro-5-pyridyl, 2-chloro-5-pyridylmethyl or 2-chloro-5-thiazolylmethyl, in addition R⁵ and R⁶ may represent, together with the adjacent nitrogen atom, pyrrolidino, piperidino, 2-methylpiperidino, morpholino, piperazino or 1-isoxazolyl,

15

Y is CH or N, and

20 Z is 5-membered heterocyclic group which has one or two nitrogen atoms, or one nitrogen atom and either one oxygen atom or one sulfur atom and may be substituted by halogen or C₁₋₂ alkyl optionally substituted by fluorine, or 6-membered heterocyclic group which has one or two nitrogen atoms and may be substituted by halogen or C₁₋₂ alkyl optionally substituted by fluorine, provided that where Y is CH, then R¹ is methyl or ethyl, and that where R² is hydrogen and R³ is

25



30 in which either R⁵ or R⁶ is hydrogen, the other is allyl, phenyl optionally substituted by chlorine, 2-chloro-5-pyridylmethyl or 2-chloro-5-thiazolylmethyl, then Y is N, and with the exception of the case where R¹ is hydrogen, methyl or ethyl,

R² is hydrogen, methyl, ethyl or n-propyl,

R³ is

35



40 in which R⁵ and R⁶ are hydrogen or C₁₋₄ alkyl, Y is CH or N, and Z is 5- or 6-membered heterocyclic group having at least one nitrogen atom which may be substituted by halogen or C₁₋₂ alkyl optionally substituted by fluorine.

Very particularly preferred nitro compounds of the formula (I) are those in which

R¹ is hydrogen or methyl

45

R² is hydrogen, methyl, ethyl, allyl, propargyl, methoxy or 2-chloro-5-pyridylmethyl,

R³ is

50



55 in which R⁵ and R⁶ are hydrogen, C₁₋₂ alkyl optionally substituted by at least one substituent selected from a group consisting of mercapto, methoxy, cyclohexyl, amino, methylamino, dimethylamino, methoxycarbonyl and cyano, allyl, 2-chloroallyl, benzyl, 3- or 4-chlorobenzyl, methoxy, hydroxy, formyl, methylamino, dimethylamino, amino, acetyl, benzoyl, 6-chloronicotinoyl, 2-chloro-5-pyridyl or 2-chloro-5-pyridylmethyl,

Y is N, and

Z is 2-chloro-5-pyridyl,
with the exception of the case where R¹ is hydrogen or methyl,
R² is hydrogen, methyl or ethyl,
R³ is

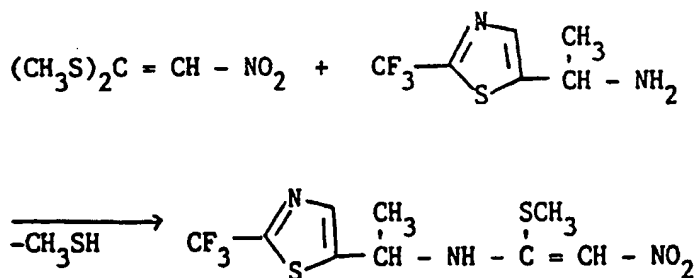


in which R⁵ and R⁶ are hydrogen or C₁₋₂ alkyl, Y is N, and Z is 2-chloro-5-pyridyl.

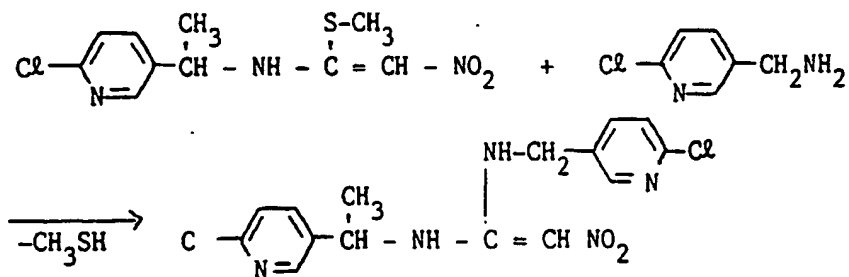
Specifically, the following compounds may be mentioned:

1-{N-[1-(2-chloro-5-pyridyl)ethyl]-N-methylamino}-1-(2-chloro-5-pyridylmethyl)amino-2-nitroethylene,
1-allyl-3-(2-chloro-5-pyridylmethyl)-2-nitroguanidine, and
1,3-bis-(2-chloro-5-pyridylmethyl)-2-nitroguanidine.

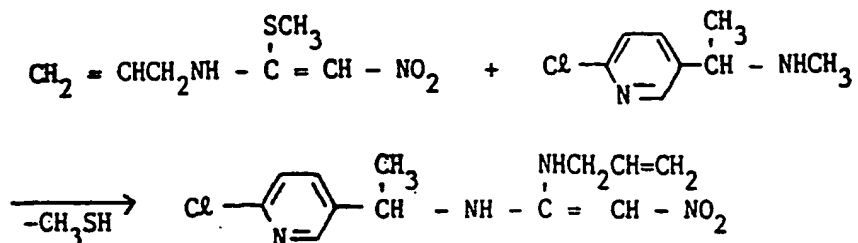
If, for example, in the above process a), 1,1-bis-methylthio-2-nitroethylene and 1-(2-trifluoromethyl-5-thiazolyl)ethylamine are used as starting materials, the course of the reaction can be represented by the following equation:



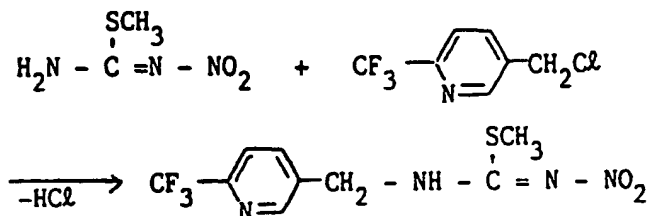
If, for example, in the above process b), 1-[1-(2-chloro-5-pyridyl)ethylamino]-1-methylthio-2-nitroethylene and 2-chloro-5-pyridylmethylamine are used as starting materials, the course of the reaction can be represented by the following equation:



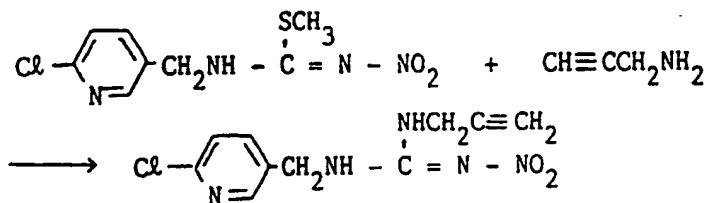
If, for example, in the above process c), 1-allylamino-1-methylthio-2-nitroethylene and N-methyl-1-(2-chloro-5-pyridyl)ethylamine are used as starting materials, the course of the reaction can be represented by the following equation:



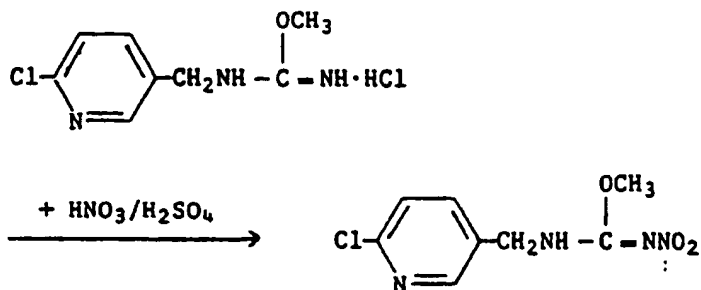
If, for example, in the above process d), 3-nitro-2-methylisothiurea and 5-chloromethyl-2-trifluoromethylpyridine are used as starting materials, the course of the reaction can be represented by the following equation:



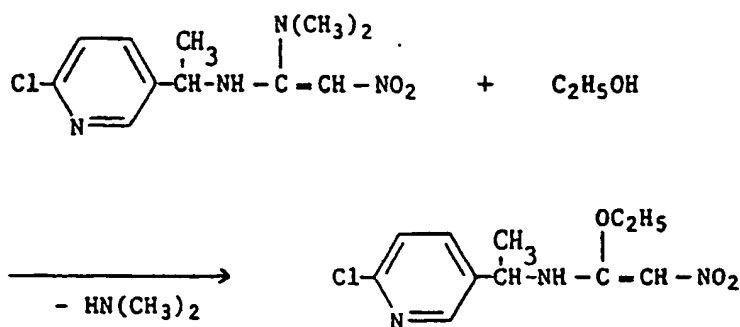
If, for example, in the above process e), 1-(2-chloro-5-pyridylmethyl)-3-nitro-2-methylisothiurea and propargylamine are used as starting materials, the course of the reaction can be represented by the following equation:



If, for example, in the above process f), 1-(2-chloro-5-pyridylmethyl)-2-methylisourea is used as a starting material, the course of the reaction can be represented by the following equation:



If, for example, in the above process g), 1-[1-(2-chloro-5-pyridyl)ethylamino]-1-dimethylamino-2-nitroethylene and ethanol are used as starting materials, the course of the reaction can be represented by the following equation:



In the process a), the compounds of the formula (II) as a starting material mean ones based on the aforementioned definition of R⁴.

In the formula (II), R⁴ preferably have the meaning already given above:

The compounds of the formula (II) include known compounds (see e.g. Chem. Ber., vol. 100, pages 591 - 604, 1967), and as an example, 1,1-bis-methylthio-2-nitroethylene can be exemplified.

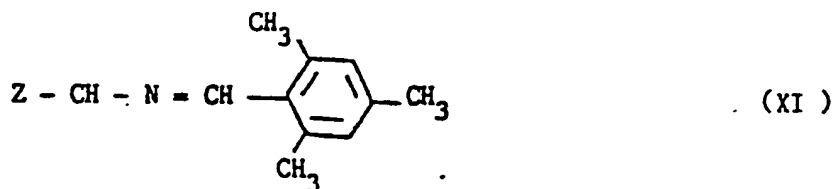
The compounds of the formula (III) as a starting material mean compounds based on the aforementioned definitions of R⁷, R² and Z.

In the formula (III), R⁷, R² and Z preferably have the meanings already given above.

The compounds of the formula (III) include in part known compounds [see Nihon Kagaku Zasshi (Periodical of Japanese Chemistry), vol. 83, pages 218 -222, 1962, J. Chem. Soc. Perkin I, 1979, pages 2364 - 2368].

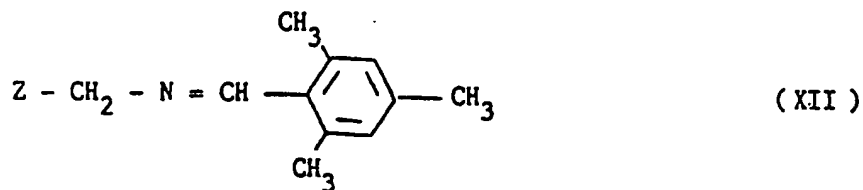
The compounds of the formula (III), for instance, may be prepared in accordance with a method described in the above reference, J. Chem. Soc. Perkin I, 1979, pages 2364 - 2368.

The compounds of the formula (III), in case where R² is hydrogen, can be obtained when compounds of the formula (XI)



wherein R⁷ and Z have the same meanings as mentioned above, are hydrolyzed.

The compounds of the formula (XI) can be obtained when Schiff-bases of the formula (XII)



wherein Z has the same meaning as mentined above, are alkylated by reacting with compounds of the formula (XIII)

R⁷ - Hal (XIII)

wherein R⁷ has the same meaning as mentioned above, and Hal is halogen,

in the presence of catalytic amounts of butyl-lithium and in the presence of an inert solvent such as tetrahydrofuran.

The compounds of the formula (XII) can be obtained when compounds of the formula (XIV)

Z - CH₂ - NH₂ (XIV)

wherein Z has the same meaning as mentioned above,

are reacted with mesitaldehyde in the presence of inert solvents.

The compounds of the formula (XIV) include known ones described in the U.S. Patent No. 4,499,097, and the aforesaid Nihon Kagaku Zasshi.

In the process b), the compounds of the formula (Ia) as a starting material correspond to a part of the compounds of the formula (I) which can be prepared by the above process a).

5 The compounds of the formula (IV) as a starting material mean ones based on the aforementioned definitions of R⁵ and R⁶.

In the formula (IV), R⁵ and R⁶ preferably have the meanings already given above.

The compounds of the formula (IV) are well known in the field of organic chemistry, and as examples, there may be mentioned: methylamine, diethylamine and so on.

10 In the process c), the compounds of the formula (V) as a starting material mean ones based on the aforementioned definitions of R⁴, R⁵ and R⁶.

In the formula (V), R⁴, R⁵ and R⁶ preferably have the meanings already given above.

The compounds of the formula (V) can in general be obtained when the aforementioned compounds of the formula (II) are reacted with the aforementioned compounds of the formula (IV).

15 As examples of the compounds of the formula (V), there may be mentioned:

1-allylamino-1-methylthio-2-nitroethylene, 1-(2-chloro-5-pyridylmethylamino)-1-methylthio-2-nitroethylene and so on.

In the process d), the compounds of the formula (VI) as a starting material mean ones based on the aforementioned definitions of R² and R⁴.

20 In the formula (VI), R² and R⁴ preferably have the meanings already given above.

The compounds of the formula (VI) are known (see e.g. J. Am. Chem. Soc., vol. 76, pages 1877 - 1879, 1954), and as examples, there may be mentioned:

3-nitro-2-methylisothiurea, 1,2-dimethyl-3-nitroisothiurea, 1,1,2-trimethyl-3-nitroisothiurea and so on.

25 The compounds of the formula (VII) as a starting material mean those based on the aforementioned definitions of R¹, Z and M.

In the formula (VII), R¹ and Z preferably have the meanings already given above, and M preferably represents chlorine, bromine or tosyloxy.

The compounds of the formula (VII) include known compounds (see Japanese Patent Laid-open Nos. 178,981/1986, 178,982/1986 or 183,271/1986), and as examples, there may be mentioned:

30 2-chloro-5-chloromethylpyridine,

2-chloro-5-chloromethylthiazole,

5-chloromethyl-2-trifluoromethylpyridine and so on.

In the process e), the compounds of the formula (Id) are a part of the compounds of the formula (I) which can be prepared by the above process d).

35 In the process f), the compounds of the formula (VIII) as a starting material mean ones based on the aforementioned definitions of R¹, R², R⁴, Z and M.

In the formula (VIII), R¹, R², R⁴, Z and M preferably have the meanings already given above.

The compounds of the formula (VIII) are novel and in general, can be obtained when compounds of the formula (XV)

40



45

wherein R¹, R² and Z have the same meanings as mentioned above, are reacted with compounds of the formula (XIV)

R⁴ - M (XIV)

50 wherein R⁴ and M have the same meanings as mentioned above.

The above compounds of the formula (XV) in general can be obtained when the aforementioned compounds of the formula (III) are reacted with urea.

The above compounds of the formula (XVI) are well-known in the field of organic chemistry, and as examples there may be mentioned:

55 methyl, ethyl, n-propyl, iso-propyl and 3-pyridylmethyl esters of p-toluenesulfonic acid, and monochlorides of methane, ethane and propane etc.

As examples of the compounds of the formula (XV), there may be mentioned:

1-(2-chloro-5-pyridylmethyl)urea, 1-(2-chloro-5-thiazolyl)urea, 1-(2-chloro-5-pyridyl)-1-methylurea,

1-[1-(2-chloro-5-pyridyl)ethyl]urea and so on.

As examples of the compounds of the formula (VIII), there may be mentioned: hydrochloride or p-toluenesulfonate of 1-(2-chloro-5-pyridylmethyl)-2-methylisourea, hydrochloride of 1-(2-chloro-5-pyridylmethyl)-2-methylisourea, or p-toluenesulfonate thereof,

5 hydrochloride of 1-(2-chloro-5-thiazolylmethyl)-2-methylisourea, or p-toluenesulfonate and so on.

In the process g), the compounds of the formula (IX) as a starting material mean ones based on the aforementioned definitions of R^7 , R^2 and Z.

The compounds of the formula (IX) are a part of the compounds of the formula (I) which can be prepared by the above process b) or c), and as examples there may be mentioned:

10 1-[1-(2-chloro-5-pyridyl)ethylamino]-1-dimethylamino-2-nitroethylene and 1-[1-(2-chloro-5-thiazolyl)ethylamino]-1-dimethylamino-2-nitroethylene.

The compounds of the formula (X) mean ones based on the aforementioned definition of R^4 .

In the formula (x), R^4 has the meaning already given above.

The compounds of the formula (X) are well-known in the field of organic chemistry, and as examples
15 there may be mentioned:

methanol, ethanol, propanol, phenol and so on.

Suitable diluents in the process a) are all inert solvents.

These preferentially include water; aliphatic-, cycloaliphatic- and aromatic- hydrocarbons optionally chlorinated such as hexane, cyclohexane, petroleum ether, ligroin, benzene, toluene, xylene, methylene
20 chloride, chloroform, carbon tetrachloride, ethylene chloride, trichloroethylene, chlorobenzene and the like; ethers such as diethyl ether, methyl ethyl ether, di-isopropyl ether, dibutyl ether, propylene oxide, dioxane, tetrahydrofuran and the like; ketones such as acetone, methylethyl ketone, methyl-iso-propyl ketone, methyl-iso-butyl ketone; nitriles such as acetonitrile, propionitrile, acrylonitrile and the like; alcohols such as methanol, ethanol, iso-propanol, butanol, ethylene glycol and the like; esters such as ethyl acetate, amyl
25 acetate; acid amides such as dimethyl formamide, dimethyl acetamide and the like; and sulfones and sulfoxides such as dimethyl sulfoxide, sulfolane and the like; and bases, for example, such as pyridine.

In the process a), the reaction temperature can be varied within a wide range. In general, the reaction is carried out at a temperature of from about 0 °C to 150 °C, preferably from about 20 °C to about 90 °C.

In general, the reaction is preferably carried out under normal pressure, and also elevated or reduced
30 pressure.

In carrying out the process a), for instance, about 0.9 to slightly excessive molar amount of the compounds of the formula (III) may be employed per mole of the compounds of the formula (II), and the mixture is reacted in the presence of inert solvents under heat-reflux condition until the generation of mercaptan ceases, so that the desired compounds of the formula (I) can be obtained.

35 In carrying out the process b), suitable diluents include the same solvents as exemplified for the process a).

In the process b), the reaction temperature can be varied within a wide range. For example, the reaction is carried out at a temperature in the range of from about 0 °C to about 150 °C, preferably from about 20 °C to about 90 °C.

40 In general, the reaction is preferably carried out under normal pressure, and also elevated or reduced pressure.

In carrying out process b), for instance, equi-molar to slightly excessive molar amount of the compounds of the formula (IV) may be employed per mole of the compounds of the formula (Ia), and the mixture is reacted in the presence of inert solvents, so that the desired compounds of the formula (I) can be
45 obtained.

In carrying out the process c), suitable diluents include the same solvents as exemplified for the process a).

50 In the process c), the reaction temperature can be varied within a wide range. For example, the reaction is carried out a temperature in the range of from about 0 °C to about 150 °C, preferably from about 20 °C to about 90 °C.

In general, the reaction is preferably carried out under normal pressure, and also elevated or reduced pressure.

55 In carrying out process c), for instance, about 0.9 to slightly excessive molar amount of the compounds of the formula (III) may be employed per mole of the compounds of the formula (V), and the mixture is reacted in the presence of inert solvents under heat-reflux condition, so that the desired compounds of the formula (I) can be obtained.

In carrying out the process d), suitable diluents include the same solvents as exemplified for the process a).

The process d) may be carried out in the presence of acid binders, such as hydroxide, hydride, carbonate, bicarbonate and alcolate of alkali metal, and tertiary amines, for examples, triethylamine and diethylaniline, and pyridene.

In the process d), the reaction temperature can be varied within a wide range. For example, the reaction is carried out at a temperature in the range of from about 0 °C to boiling point of the reaction mixture, preferably from about 0 °C to about 80 °C.

In general, the reaction is preferably carried out under normal pressure, and also elevated or reduced pressure.

In carrying out the process d), for instance, equi-molar to about 1.2 mole, preferably equi-molar to about 1.1 mole amount of the compounds of the formula (VII) may be employed per mole of the compounds of the formula (VI), and the mixture is reacted in the presence of inert solvents, for example, dimethylsulfoxide and in the presence of a base, sodium hydride, so that the desired compounds of the formula (I) can be obtained.

In carrying out the process e), suitable diluents include the same solvents as exemplified for the process a).

In the process e), the reaction temperature can be varied within a wide range. For example, the reaction is carried out at a temperature in the range of from about 0 °C to about 150 °C, preferably from about 20 °C to about 90 °C.

In general, the reaction is preferably carried out under normal pressure, and also elevated or reduced pressure.

In carrying out the process e), for instance, equi-molar to slightly excessive molar amount of the compounds of the formula (IV) may be employed per mole of the compounds of the formula (Id), and the mixture is reacted in the presence of inert solvents, so that the desired compounds of the formula (I) can be obtained.

In carrying out the process f), for instance, the compounds of the formula (VIII) which is dissolved in concentrated sulfuric acid are reacted with fuming nitric acid having a purity of higher than 98% at a low temperature, preferably at 0 °C or less than 0 °C, so that the desired compounds of the formula (I) can be obtained.

In carrying out the process g), suitable diluents include the solvents as exemplified for the process a), excluding alcohols.

In the process g), the reaction temperature can be varied within a wide range. For example, the reaction is carried out at a temperature in the range of from about 0 °C to about 120 °C, preferably from about 50 °C to about 90 °C.

In general, the reaction is preferably carried out under normal pressure, and also elevated or reduced pressure.

In carrying out the process g), for instance, an excessive molar amount of the compounds of the formula (X) may be employed per mole of the compounds of the formula (IX), and the mixture is reacted under heat-reflux, so that the desired compounds of the formula (I) can be obtained.

The active compounds are well tolerated by plants, have a favourable level of toxicity to warm-blooded animals, and can be used for combating arthropod pests, especially insects which are encountered in agriculture, in forestry, in the protection of stored products and of materials, and in the hygiene field. They are active against normally sensitive and resistant species and against all or some stages of development. The above-mentioned pests include:

- from the class of the Isopoda, for example Oniscus Asellus, Armadillidium vulgare and Porcellio scaber;
- from the class of the Diplopoda, for example Blaniulus guttulatus;
- from the class of the Chilopoda, for example Geophilus carpophagus and Scutigera spec.;
- from the class of the Symphyla, for example Scutigera immaculata;
- from the order of the Thysanura, for example Lepisma saccharina;
- from the order of the Collembola, for example Onychiurus armatus;
- from the order of the Orthoptera; for example Blatta orientalis, Periplaneta americana, Leucophaea maderae, Blattella germanica, Acheta domesticus, Gryllotalpa spp., Locusta migratoria migratorioides, Melanoplus differentialis and Schistocerca gregaria;
- from the order of the Dermaptera, for example Forficula auricularia;
- from the order of the Isoptera, for example Reticulitermes spp.;
- from the order of the Anoplura, for example Phylloxera vastatrix, Pemphigus spp., Pediculus humanus corporis, Haematopinus spp. and Linognathus spp.;
- from the order of the Mallophaga, for example Trichodectes spp. and Damalinea spp.;
- from the order of the Thysanoptera, for example Hercinothrips femoralis and Thrips tabaci.

from the order of the Heteroptera, for example Eurygaster spp., Dysdercus intermedius, Piesma quadrata, Cimex lectularius, Rhodnius prolixus and Triatoma spp.;

from the order of the Homoptera, for example Aleurodes brassicae, Bemisia tabaci, Trialeurodes vaporariorum, Aphis gossypii, Brevicoryne brassicae, Cryptomyzus ribis, Aphis fabae, Doralis pomi,
 5 Eriosoma lanigerum, Hyalopterus arundinis, Macrosiphum avenae, Myzus spp., Phorodon humuli, Rhopalosiphum padi, Empoasca spp., Euscelis bilobatus, Nephotettix cincticeps, Lecanium corni, Saissetia oleae, Laodelphax striatellus, Nilaparvata lugens, Aonidiella aurantii, Aspidiotus hederae, Pseudococcus spp. and Psylla spp.;

from the order of the Lepidoptera, for example Pectinophora gossypiella, Bupalus piniarius, Cheimatobia
 10 brumata, Lithocolletis blancardella, Hyponomeuta padella, Plutella maculipennis, Malacosoma neustria, Euproctis chrysorrhoea, Lymantria spp., Bucculatrix thurberiella, Phyllocnistis citrella, Agrotis spp., Euxoa spp., Feltia spp., Earias insulana, Heliothis spp., Spodoptera exiqua, Mamestra brassicae, Panolis flammea, Prodenia litura, Spodoptera spp., Trichoplusia ni, Carpocapsa pomonella, Pieris spp., Chilo spp., Pyrausta nubilalis, Ephestia kuehniella, Galleria mellonella, Cacoecia podana, Capua reticulana, Choristoneura
 15 fumiferana, Clysia ambiguella, Homona magnanima and Tortrix viridana;

from the order of the Coleoptera, for example Anobium punctatum, Rhizophorthera dominica, Acanthoscelides
obtectus, Acanthoscelides obtectus, Hylotrupes bajulus, Agelastica alni, Leptinotarsa decemlineata, Phaedon
cochleariae, Diabrotica spp., Psylliodes chrysocephala, Epilachna varivestis, Atomaria spp., Oryzaephilus
surinamensis, Anthonomus spp., Sitophilus spp., Otiorynchus sulcatus, Cosmopolites sordidus, Ceuthor-
 20 rhynchus assimilis, Hypera postica, Dermestes spp., Trogoderma spp., Anthrenus spp., Attagenus spp.,
Lyctus spp., Meligethes aeneus, Ptinus spp., Niptus hololeucus, Gibbium psyllodes, Tribolium spp.,
Tenebrio molitor, Agriotes spp., Conoderus spp., Melolontha melolontha, Amphimallon solstitialis and
Costelytra zealandica;

from the order of the Hymenoptera for example Diprion spp., Hoplocampa spp., Lasius spp., Monomorium
 25 pharaonis and Vespa spp.;

from the order of the Diptera, for example Aedes spp., Anopheles spp., Culex spp., Drosophila melanog-
aster, Musca spp., Fannia spp., Calliphora erythrocephala, Lucilia spp., Chrysomyia spp., Cuterebra spp.,
Gastrophilus spp., Hyppobosca spp., Stomoxys spp., Oestrus spp., Hypoderma spp., Tabanus spp., Tannia
 30 spp., Bibio hortulanus, Oscinella frit, Phorbia spp., Pegomyia hyoscyami, Ceratitis capitata, Dacus oleae and
Tipula paludosa;

from the order of the Siphonaptera, for example Xenopsylla cheopis and Ceratophyllus spp.;

from the class of the Arachnida, for example Scorpio maurus and Latrodectus mactans;

from the order of the Aranina, for example Acarus siro, Argas spp., Ornithodoros spp., Dermanyssus
gallinae, Eriophyes ribis, Phyllocoptura oleivora, Boophilus spp., Rhipicephalus spp., Amblyomma spp.,
 35 Hyalomma spp., Ixodes spp., Psoroptes spp., Chorioptes spp., Sarcoptes spp., Tarsonemus spp., Bryobia
praetiosa, Panonychus spp. and Tetranychus spp..

The plant-parasitic nematodes include Pratylenchus spp., Radopholus similis, Ditylenchus dipsaci,
Tylenchulus semipenetrans, Heterodera spp., Meloidogyne spp., Aphelenchoides spp., Longidorus spp.,
Xiphinema spp., and Trichodorus spp..

40 Furthermore, in the field of veterinary medicine, the novel compound of the present invention can
effectively be employed for combating a variety of noxious animal-parasitic pests (internal- and external-
parasitic pests), e.g., parasitic insects and nematodes. Such animal-parasitic pests may be exemplified as
follows:

From the class of insects, e.g., Gastrophilus spp., Stomoxys spp., Tricodectes spp., Rhodius spp.,
 45 Ctenocephalides canis and the like.

The active compounds can be converted into the customary formulations, such as solutions, emulsions,
wetable powders, suspensions, powders, foams, pastes, granules, aerosols, natural and synthetic materials
impregnated with active compound, very fine capsules in polymeric substances, coating compositions for
use on seed, and formulations used with burning equipment, such as fumigating cartridges, fumigating cans
50 and fumigating coils, as well as ULV cold mist and warm mist formulations.

These formulations can be produced in known manner, for example by mixing the active compounds
with extenders, that is to say liquid or liquefied gaseous or solid diluents or carriers, optionally with the use
of surface-active agents, that is to say emulsifying agents and/or dispersing agents and/or foam-forming
agents. In the case of the use of water as an extender, organic solvents can, for example, also be used as
55 auxiliary solvents.

As liquid solvents diluents or carriers, there are suitable in the main, aromatic hydrocarbons, such as
xylene, toluene or alkyl naphthalenes, chlorinated aromatic or chlorinated aliphatic hydrocarbons, such as
chlorobenzenes, chloroethylenes or methylene chloride, aliphatic hydrocarbons, such as cyclohexane or

paraffins, for example mineral oil fractions, alcohols, such as butanol or glycol as well as their ethers and esters, ketones, such as acetone, methyl ethyl ketone, methyl isobutyl ketone or cyclohexanone, or strongly polar solvents, such as dimethylformamide and dimethyl-sulphoxide, as well as water.

By liquefied gaseous diluents or carriers are meant liquids which would be gaseous at normal temperature and under normal pressure, for example aerosol propellants, such as halogenated hydrocarbons as well as butane, propane, nitrogen and carbon dioxide.

As solid carriers there may be used ground natural minerals, such as kaolins, clays, talc, chalk, quartz, attapulgite, montmorillonite or diatomaceous earth, and ground synthetic minerals, such as highly-dispersed silicic acid, alumina and silicates. As solid carriers for granules there may be used crushed and fractionated natural rocks such as calcite, marble, pumice, sepiolite and dolomite, as well as synthetic granules of inorganic and organic meals, and granules of organic material such as sawdust, coconut shells, maize cobs and tobacco stalks.

As emulsifying and/or foam-forming agents there may be used non-ionic and anionic emulsifiers, such as polyoxyethylene-fatty acid esters, polyoxyethylene-fatty alcohol ethers, for example alkylaryl polyglycol ethers, alkyl sulphonates, alkyl sulphates, aryl sulphonates as well as albumin hydrolysis products. Dispersing agents include, for example, lignin sulphite waste liquors and methylcellulose.

Adhesives such as carboxymethylcellulose and natural and synthetic polymers in the form of powders, granules or latices, such as gum arabic, polyvinyl alcohol and polyvinyl acetate, can be used in the formulation.

It is possible to use colorants such as inorganic pigments, for example iron oxide, titanium oxide and Prussian Blue, and organic dyestuffs, such as alizarin dyestuffs, azo dyestuffs or metal phthalocyanine dyestuffs, and trace nutrients, such as salts of iron, manganese boron, copper, cobalt, molybdenum and zinc.

The formulations in general contain from 0.1 to 95 per cent by weight of active compound, preferably from 0.5 to 90 per cent by weight.

The active compounds according to the invention can be present in their commercially available formulations and in the use forms, prepared from these formulations, as a mixture with other active compounds, such as insecticides, baits, sterilising agents, acaricides, nematocides, fungicides, growth-regulating substances or herbicides. The insecticides include, for example, phosphates, carbamates, carboxylates, chlorinated hydrocarbons, phenylureas, substances produced by microorganisms.

The active compounds according to the invention can furthermore be present in their commercially available formulations and in the use forms, prepared from these formulations, as a mixture with synergistic agents. Synergistic agent are compounds which increase the action of the active compounds, without it being necessary for the synergistic agent added to be active itself.

The active compound content of the use forms prepared from the commercially available formulations can vary within wide limits. The active compound concentration of the use forms can be from 0.0000001 to 100% by weight of active compound, preferably between 0.0001 and 1% by weight.

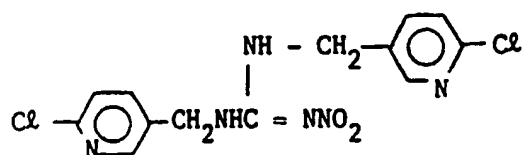
The compounds are employed in a customary manner appropriate for the use forms.

When used against hygiene pests and pests of stored products, the active compounds are distinguished by an excellent residual action on wood and clay as well as a good stability to alkali on limed substrates.

The preparation and use of the active compounds according to the invention can be seen from the following examples.

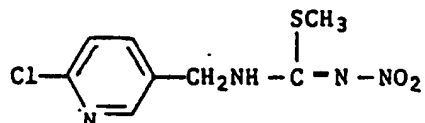
Preparative example:

Example 1



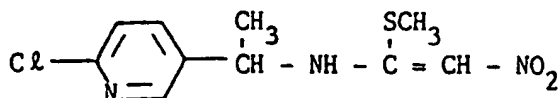
1-2-(chloro-5-pyridylmethyl)-2-methyl-3-nitroisothiourea (1.0 g) was dissolved in ethanol (20 ml) and to the solution was added 2-chloro-5-aminomethylpyridine (0.55 g) at room temperature, followed by one day stirring at 30 °C. The ethanol in the solution was distilled off under reduced pressure and it was purified on a chromatographic column (the eluent was a mixture of methanol and chloroform) so as to obtain the
 5 desired 1,3-bis-(2-chloro-5-pyridylmethyl)-2-nitroguanidine (1.0 g) having a melting point in the range of from 179 to 182 °C.

Referential Example 1



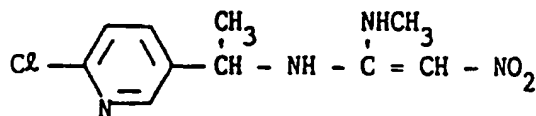
To a solution of 2-methyl-3-nitroisothiourea (15.0 g) in dimethylsulfoxide (100 ml) was gradually added sodium hydride (oil free 2.9 g) at 5 °C, while being stirred for one hour. Thereafter, 2-chloro-5-chloromethyl
 20 pyridine (18.0 g) was added to the solution at a temperature in the range of from 5 to 10 °C, followed by an overnight stirring thereof at room temperature. After the dimethylsulfoxide in the solution having been distilled off under reduced pressure, the resulting residue was purified on a chromatographic column (the eluent was a mixture of ethanol and chloroform), so as to obtain the desired 1-(2-chloro-5-pyridylmethyl)-2-
 25 methyl-3-nitroisothiourea (2.0 g) having a melting point in the range of from 141 to 143 °C.

Referential Example 2



A mixture of 1-(2-chloro-5-pyridyl)ethylamine (4.7 g), 1,1-bis-methylthio-2-nitroethylene (5.0 g) and ethanol (50 ml) was refluxed under heating until the generation of mercaptan ceased. Then, the ethanol was
 35 distilled off from the mixture under reduced pressure and the resulting residue was purified on chromatographic column (the eluent mixture = ethanol + chloroform) to obtain the desired 1-{1-(2-chloro-5-pyridyl)-
 40 ethylamino}-1-methylthio-2-nitroethylene (3.3 g) having a melting point in the range of from 136 to 140 °C.

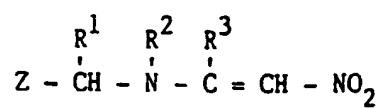
Referential Example 3



To a solution comprising 1-{1-(2-chloro-5-pyridyl)ethylamino}-1-methylthio-2-nitroethylene (2.7 g) in ethanol (50 ml) was added dropwise an aqueous solution of methylamine (40%, 3 g) at 50 °C, followed by a
 45 two hours stirring at the same temperature.

Upon the solution having been cooled to room temperature, the aimed product was separated in the
 50 form of crystals, which were filtered and washed with ethanol to obtain the desired 1-{1-(2-chloro-5-pyridyl)-
 ethylamino}-1-methylamino-2-nitroethylene (1.5 g) having a melting point in the range of from 183 to 186 °C.

The compounds of the following formula (I),

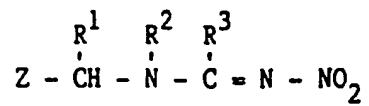


5

which can be prepared in the same way as in the above Referential Examples 2 and 3 are shown in Table 1.

The compounds of the following formula (I),

10



15

which can be prepared in the same way as in the above Example 1 and Referential Example 1 are shown in Table 2.

20

25

30

35

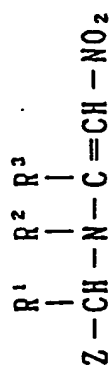
40


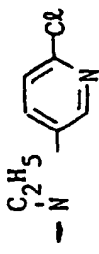
45

50

55

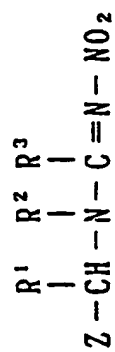
Table 1


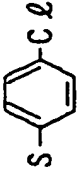



| Comp. No. | Z | R ¹ | R ² | R ³ |
|-----------|-------------------------------|---------------------------------|-----------------|---|
| 1 | 2-trifluoromethyl-5-thiazolyl | C ₃ H _{7-n} | H | SC ₂ H ₅ |
| 2 | 2-trifluoromethyl-5-thiazolyl | CH ₃ | H | SCH ₃ |
| 3 | 2-chloro-5-pyridyl | C ₄ H _{9-n} | H | NHCH ₂ CH=CH ₂ |
| 4 | 2-chloro-5-pyridyl | CH ₃ | H | NHCH ₂ CH=CH ₂ |
| 5 | 2-chloro-5-pyridyl | CH ₃ | CH ₃ |  |
| 6 | 2-chloro-5-oxazolyl | CH ₃ | H |  |

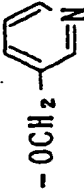
| Comp. No. | Z | R ¹ | R ² | R ³ | |
|-----------|--------------------|-----------------|-----------------|----------------------------------|--|
| 7 | 2-chloro-5-pyridyl | CN | H | SCH ₃ | |
| 8 | 2-chloro-5-pyridyl | CN | CH ₃ | SCH ₃ | |
| 9 | 2-chloro-5-pyridyl | CN | H | NH ₂ | |
| 10 | 2-chloro-5-pyridyl | CN | CH ₃ | NH ₂ | |
| 11 | 2-chloro-5-pyridyl | CN | H | NHCH ₃ | |
| 12 | 2-chloro-5-pyridyl | CN | CH ₃ | NHCH ₃ | |
| 13 | 2-chloro-5-pyridyl | CN | CH ₃ | N(CH ₃) ₂ | |
| 14 | 2-chloro-5-pyridyl | CH ₃ | H | OC ₂ H ₅ | |



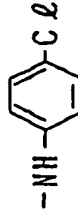

Table 2



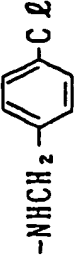
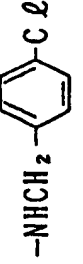
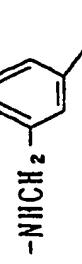
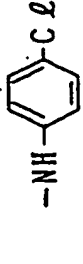



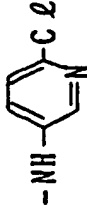
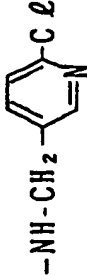
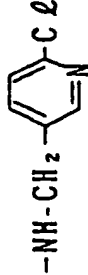
| Comp. No. | Z | R ¹ | R ² | R ³ |
|-----------|------------------------------|---------------------------------|-------------------------------|---|
| 15 | 2-trifluoro-methyl-5-pyridyl | C ₂ H ₅ | H | SCH ₃ |
| 16 | 2-trifluoro-methyl-5-pyridyl | C ₃ H _{7-n} | H | SCH ₂ C≡CH |
| 17 | 2,3-dichloro-5-pyridyl | H | H |  |
| 18 | 3-methyl-5-isoxazolyl | H | H |  |
| 19 | 2-chloro-5-thiazolyl | H | C ₂ H ₅ |  |

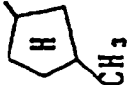
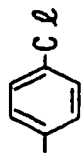
| Comp. No. | Z | R ¹ | R ² | R ³ | |
|-----------|-------------------------------|-----------------|-----------------|------------------------------------|--|
| 20 | 2-chloro-5-thiazolyl | H | H | OCH ₃ | |
| 21 | 2-chloro-5-pyridyl | H | H | OCH ₃ | |
| 22 | 2-chloro-5-pyridyl | H | CH ₃ | OCH ₃ | |
| 23 | 2-methyl-1,3,4-oxadiazol-5-yl | H | H | OCH ₃ | |
| 24 | 1,2,5-thiadiazol-3-yl | H | H | OCH ₃ | |
| 25 | 3-methyl-5-isoxazolyl | CH ₃ | H | OC ₂ H ₅ | |
| 26 | 2-chloro-5-thiazolyl | H | H | OC ₃ H _{7-n} | |
| 27 | 1,2,5-thiadiazol | H | H | OC ₃ H _{7-iso} | |

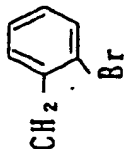
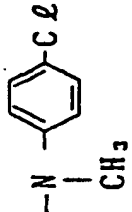
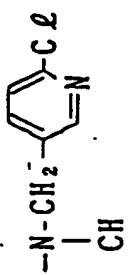
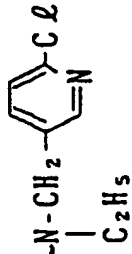
| Comp. No. | Z | R ¹ | R ² | R ³ | |
|-----------|----------------------|---------------------------------|----------------------|---|--|
| 28 | 2-pyrazinyl | C ₃ H _{7-n} | H |  | |
| 29 | 2-chloro-5-pyridyl | H | CH ₂ C≡CH | -NHCH ₃ | |
| 30 | 2-cyano-5-pyridyl | H | CH ₃ | -NHC ₂ H ₅ | |
| 31 | 2-chloro-5-thiazolyl | H | H | -NHCH ₂ CCl=CH ₂ | |
| 32 | 2-methyl-5-pyridyl | H | CH ₃ | -NHCH ₂ CCl=CH ₂ | |
| 33 | 2-chloro-5-pyridyl | H | H | -NHCH ₂ CH=CH ₂ | |
| 34 | 2-chloro-5-pyridyl | H | CH ₃ | -NHCH ₂ CH=CH ₂ | |

| Comp. No. | Z | R ¹ | R ² | R ³ | |
|-----------|----------------------|----------------|-----------------|--|--------------------------------------|
| 35 | 2-methyl-5-pyrazinyl | H | CH ₃ | -NHCH ₂ CH=CH ₂ | n _D ²⁰ 1.15955 |
| 36 | 2-chloro-5-pyridyl | H | H | -NHCH ₂ C≡CH | |
| 37 | 2-chloro-5-pyridyl | H | CH ₃ | -NHCH ₂ C≡CH | |
| 38 | 2-chloro-5-pyridyl | H | H |  | |
| 39 | 2-chloro-5-pyridyl | H | CH ₃ |  | |
| 40 | 2-chloro-5-thiazolyl | H | CH ₃ |  | |
| 41 | 2-methyl-5-pyrazinyl | H | CH ₃ | -NHCH ₂ -  | |

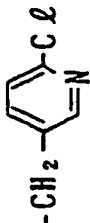

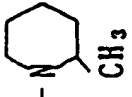

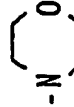
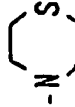
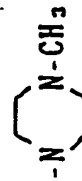
| Comp. No. | Z | R ¹ | R ² | R ³ | |
|-----------|-----------------------|----------------|-----------------|---|--|
| 42 | 2-chloro-5-pyridyl | H | H |  | |
| 43 | 2-chloro-5-pyridyl | H | CH ₃ |  | |
| 44 | 2-chloro-5-pyridyl | H | H |  | |
| 45 | 2-chloro-5-pyridyl | H | CH ₃ |  | |
| 46 | 2-chloro-5-pyridyl | H | CH ₃ |  | |
| 47 | 1,2,5-thiadiazol-3-yl | H | H |  | |


| Comp. No. | Z | R ¹ | R ² | R ³ | |
|-----------|--------------------|----------------|-----------------|---|----------------|
| 48 | 2-chloro-5-pyridyl | H | H |  | mp. 179~182 °C |
| 49 | 2-chloro-5-pyridyl | H | CH ₃ |  | |
| 50 | 2-chloro-5-pyridyl | H | H |  | |
| 51 | 2-chloro-5-pyridyl | H | CH ₃ |  | |

| Comp. No. | Z | R ¹ | R ² | R ³ |
|-----------|------------------------|----------------|--|---|
| 52 | 2,3-dichloro-5-pyridyl | H |  | -N(CH ₃) ₂ |
| 53 | 2-chloro-5-pyridyl | H | CH ₂ C≡CH | -N(CH ₃) ₂ |
| 54 | 2,3-dimethyl-5-pyridyl | H |  | -N-C ₂ H ₅ CH ₃ |
| 55 | 2-chloro-5-pyridyl | H | H | -N-CH ₂ CH=CH ₂ CH ₃ |
| 56 | 2-chloro-5-pyridyl | H | H | -N-CH ₂ CH=CH ₂ CH ₃ |

| Comp. No. | Z | R ¹ | R ² | R ³ | |
|-----------|----------------------|----------------|--|---|--|
| 57 | 2-chloro-5-pyridyl | H |  | $\text{-N-CH}_2\text{CH=CHC}\ell$ CH_3 | |
| 58 | 2-methyl-5-pyrazinyl | H | H |  | |
| 59 | 2-methyl-5-pyridyl | H | H |  | |
| 60 | 2-bromo-5-pyridyl | H | H |  | |

| Comp. No. | Z | R ¹ | R ² | R ³ | |
|-----------|------------------------|----------------|--|--|----------------|
| 61 | 2-chloro-5-pyrimidinyl | H | H | $\begin{array}{c} \text{H} \\ \\ \text{---N---CH}_2\text{---} \\ \\ \text{C}_2\text{H}_5 \end{array}$ | |
| 62 | 2-fluoro-5-thiazolyl | H | $\begin{array}{c} \text{CH}_2\text{---} \\ \\ \text{---C---} \\ \\ \text{N} \end{array}$ | $\begin{array}{c} \text{---N---CH}_2\text{C}\equiv\text{CH} \\ \\ \text{C}_3\text{H}_7\text{-iso} \end{array}$ | |
| 63 | 1,2,5-oxadiazol-3-yl | H | H | $\text{---N---} \left(\text{CH}_2\text{---} \begin{array}{c} \text{---C---} \\ \\ \text{N} \end{array} \right)_2$ | |
| 64 | 2-chloro-5-pyridyl | H | H | $\begin{array}{c} \text{---N---} \\ \\ \text{Cyclopentyl} \end{array}$ | mp. 169~172 °C |



| Comp. No. | Z | R ¹ | R ² | R ³ | |
|-----------|--------------------|-----------------|--|---|--|
| 65 | 2-chloro-5-pyridyl | CH ₃ |  |  | |
| 66 | 2-chloro-5-pyridyl | H | H |  | |
| 67 | 2-chloro-5-pyridyl | H | H |  | |
| 68 | 2-chloro-5-pyridyl | H | H |  | |
| 69 | 2-chloro-5-pyridyl | H | H |  | |
| 70 | 2-chloro-5-pyridyl | H | H |  | |

| Comp. No. | Z | R ¹ | R ² | R ³ | |
|-----------|--------------------|----------------|------------------|---|--|
| 71 | 2-chloro-5-pyridyl | H | CH ₃ |  | |
| 72 | 2-chloro-5-pyridyl | H | H | NHOCH ₃ | |
| 73 | 2-chloro-5-pyridyl | H | CH ₃ | NHOCH ₃ | |
| 74 | 2-chloro-5-pyridyl | H | H | N(CH ₃)OCH ₃ | |
| 75 | 2-chloro-5-pyridyl | H | CH ₃ | N(CH ₃)OCH ₃ | |
| 76 | 2-chloro-5-pyridyl | H | OCH ₃ | NH ₂ | |
| 77 | 2-chloro-5-pyridyl | H | OCH ₃ | NHCH ₃ | |
| 78 | 2-chloro-5-pyridyl | H | OCH ₃ | N(CH ₃) ₂ | |

| Comp. No. | Z | R ¹ | R ² | R ³ | |
|-----------|----------------------|----------------|-----------------|------------------------------------|--|
| 79 | 2-chloro-5-pyridyl | H | H | NHNH ₂ | |
| 80 | 2-chloro-5-pyridyl | H | H | NHNHCH ₃ | |
| 81 | 2-chloro-5-thiazolyl | H | H | NHNHCH ₃ | |
| 82 | 2-chloro-5-thiazolyl | H | CH ₃ | NHN(CH ₃) ₂ | |
| 83 | 2-chloro-5-pyridyl | H | H | NHOH | |
| 84 | 2-chloro-5-pyridyl | H | CH ₃ | NHOH | |
| 85 | 2-chloro-5-pyridyl | CN | H | SCH ₃ | |
| 86 | 2-methyl-5-pyrazinyl | CN | CH ₃ | OC ₂ H ₅ | |

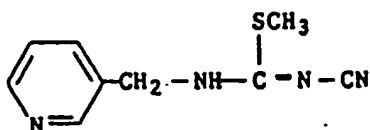
| Comp. No. | Z | R ¹ | R ² | R ³ | |
|-----------|----------------------|----------------|----------------|--|--|
| 87 | 2-chloro-5-pyridyl | CN | H | NHCH ₃ | |
| 88 | 2-chloro-5-pyridyl | CN | H | N(CH ₃) ₂ | |
| 89 | 2-chloro-5-pyridyl | H | H | NHCH ₂ CH ₂ OC ₂ H ₅ | |
| 90 | 2-chloro-5-thiazolyl | H | H | NHCH ₂ CH ₂ SH | |
| 91 | 2-chloro-5-pyridyl | H | H | NHCH ₂ CH ₂ NH ₂ | |
| 92 | 2-chloro-5-pyridyl | H | H | NHCH ₂ COOC ₂ H ₅ | |

| Comp. No. | Z | R ¹ | R ² | R ³ | |
|-----------|--------------------|----------------|-----------------|----------------------------------|----------------|
| 93 | 2-bromo-5-thienyl | H | CH ₃ | NH ₂ | mp. 159~161 °C |
| 94 | 2-bromo-5-thienyl | H | CH ₃ | NHCH ₃ | |
| 95 | 2-bromo-5-thienyl | H | CH ₃ | N(CH ₃) ₂ | |
| 96 | 2-bromo-5-thienyl | H | H | NHCH ₃ | |
| 97 | 2-chloro-5-pyridyl | H | CH ₃ | N-CHO CH ₃ | mp. 99~101 °C |

| Comp. No. | Z | R ¹ | R ² | R ³ | |
|-----------|--------------------|----------------|-----------------|---|--|
| 98 | 2-chloro-5-pyridyl | H | H | NHCOCH ₃ | |
| 99 | 2-chloro-5-pyridyl | H | CH ₃ | NHCOCH ₃ | |
| 100 | 2-chloro-5-pyridyl | H | H |  | |
| 101 | 2-chloro-5-pyridyl | H | CH ₃ |  | |

Biological tests

Comparative compound E-1



(disclosed in Japanese Patent)
 (Laid-open No. 233903/1988)

Example 5 (biological test)

Test on Nephotettix cincticeps having resistance to organophosphorus agents:-

Preparation of a test chemical

Solvent: 3 parts by weight of xylene

Emulsifier: 1 part by weight of polyoxyethylene alkyl phenyl ether

To form a suitable preparation, 1 part by weight of the active compound was mixed with the aforesaid amount of the solvent containing the aforesaid amount of the emulsifier. The mixture was diluted with water to a predetermined concentration.

Testing method

Onto rice plants, about 10 cm tall, planted in pots each having a diameter of 12 cm was sprayed 10 ml per pot of the water-dilution of each active compound in a predetermined concentration prepared as above. The sprayed chemical was dried, and a wire net having a diameter of 7 cm and a height of 14 cm was put over each pot, and 30 female imagoes of Nephotettix cincticeps showing resistance to organophosphorus agents were released into the net. The pots were each placed in a constant temperature chamber and the number of dead insects was examined 2 days later, and the Insect mortality was calculated.

As the result, for instance, compound Nos. 36 and 50 showed 100% of kill ratio at 50 ppm active ingredient.

On the other hand, as comparison, E-1 showed no killing effect at 50 ppm a.i.

Example 6 (biological test)

Test on planthoppers:-

Testing method

A water dilution in a predetermined concentration of the active compound prepared as in Example 5 was sprayed onto rice plants, about 10 cm tall, grown in pots with a diameter of 12 cm in an amount of 10 ml per pot. The sprayed chemical was dried, and a wire net, 7 cm in diameter and 14 cm tall, was put over each of the pots. Thirty female imagoes of Nilaparvata lugens Stal of a strain which showed resistance to organophosphorus chemicals were released into the net. The pots were left to stand in a constant temperature chamber and the number of dead insects was examined two days later. The kill ratio was then calculated.

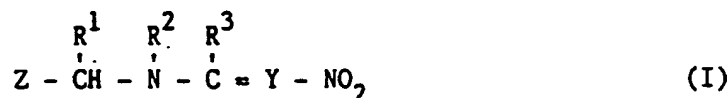
In the same way as above, the insect mortality was calculated on Sogatella furcifera Horvath and organophosphorus-resistant Laodelphax striatellus Fallén.

As the result, for instance, compound Nos. 36 and 50 showed 100% of kill ratio at 50 ppm active ingredient.

On the other hand, as comparison, E-1 showed no killing effect at 50 ppm a.i.

Claims

1) Nitro compounds of the formula (I)



wherein R¹ is hydrogen, cyano or C₁₋₄ alkyl,

R² is hydrogen, C₁₋₆ alkyl, C₃₋₄ alkenyl, C₃₋₄ alkynyl, C₃₋₈ cycloalkyl optionally substituted by C₁₋₂ alkyl, optionally substituted phenyl, optionally substituted benzyl, C₁₋₄ alkoxy or -(CH₂)_n-Z, in which n is 1 or 2 and

Z has the same meanings as stated hereinafter,

R³ is -O-R⁴, -S-R⁴ or



in which R⁴ is C₁₋₆ alkyl, C₃₋₄ alkenyl, C₃₋₄ alkynyl, C₃₋₈ cycloalkyl, optionally substituted phenyl, optionally substituted benzyl or -(CH₂)_n-Z,

in which n has the same meanings as stated above and

Z has the same meanings as stated hereinafter,

R⁵ and R⁶ are the same or different and stand for hydrogen, C₁₋₉ alkyl optionally substituted by at least one substituent selected from the group consisting of mercapto, C₁₋₂ alkoxy, C₃₋₆ cycloalkyl, amino, C₁₋₂ mono-alkylamino, C₂₋₄ (in total) dialkylamino, C₁₋₂ alkoxy-carbonyl and cyano;

or R⁵ and R⁶ are the same or different and stand for C₃₋₄ alkenyl optionally substituted by halogen, C₃₋₄ alkynyl, optionally substituted phenyl, optionally substituted benzyl, C₁₋₄ alkoxy, hydroxy, formyl, C₁₋₄ alkylamino, C₂₋₄ (in total) dialkylamino, amino, acyl, 5- or 6-membered heterocyclic group optionally substituted by halogen or C₁₋₄ alkyl, or

-CH₂-Z in which Z has the same meanings as stated hereinafter, or

R⁵ and R⁶ may form, together with the adjacent nitrogen atom, 3 to 7 membered cyclic group which may be substituted by C₁₋₂ alkyl and may have N, O or S atom as said ring member, besides the adjacent nitrogen atom,

Y is CH or N, and

Z is an optionally substituted 5- or 6-membered heterocyclic group which has at least one hetero atom selected from N, O and S and which may be benzo-fused, provided that where Y is CH,

then R¹ is cyano or C₁₋₄ alkyl, and with the exception of the case where R¹ and R² are hydrogen or C₁₋₄ alkyl, R³ is -S-R⁴ or



in which R⁴ is C₁₋₄ alkyl, R⁵ and R⁶ are hydrogen or C₁₋₄ alkyl, Y is CH or N, and Z is 5- or 6-membered heterocyclic group having at least one nitrogen atom which may be substituted by halogen or C₁₋₄ alkyl.

2) The compounds of the formula (I) according to claim 1 wherein

R¹ is hydrogen, methyl, ethyl or n-propyl,

R² is hydrogen, C₁₋₄ alkyl, allyl, propargyl,

C₅₋₆ cycloalkyl optionally substituted by methyl, phenyl optionally substituted by halogen, benzyl optionally substituted by halogen, C₁₋₃ alkoxy or -CH₂-Z¹ in which

Z¹ is pyridyl optionally substituted by halogen,

R³ is -O-R⁴, -S-R⁴ or



5

in which

R⁴ is C₁₋₄ alkyl, allyl, C₃₋₆ cycloalkyl, phenyl optionally substituted by halogen, benzyl optionally substituted by halogen or -CH₂-Z¹ in which Z¹ has the same meaning as stated above,

10 R⁵ and R⁶ are hydrogen, C₁₋₆ alkyl optionally substituted by at least one substituent selected from a group consisting of mercapto methoxy, cyclohexyl, amino, methylamino, dimethylamino, methoxycarbonyl and cyano, allyl optionally substituted by chlorine, propargyl, phenyl optionally substituted by chlorine, benzyl optionally substituted by chlorine, C₁₋₃ alkoxy, hydroxy, formyl,

15 C₁₋₃ alkylamino, dimethylamino, amino, acetyl, benzoyl, 6-chloronicotinoyl, pyridyl optionally substituted by chlorine or methyl, or -CH₂-Z² in which Z² represents the definition of Z¹ hereinbefore and 5-thiazolyl optionally substituted by chlorine, in addition R⁵ and R⁶ may form, together with the adjacent nitrogen atom, 3 to 6 membered cyclic group which may be substituted by methyl and may have N, O or S atom as said ring member, besides the adjacent nitrogen atom,

Y is CH or N, and

20 Z is 5-membered heterocyclic group which has one or two nitrogen atoms, or one nitrogen atom and either one oxygen atom or one sulfur atom and may be substituted by halogen or C₁₋₄ alkyl, or 6-membered heterocyclic groups which has one or two nitrogen atoms and may be substituted by halogen or C₁₋₄ alkyl optionally substituted by halogen and said 5- and 6-membered heterocyclic groups may be benzo-fused, provided that where Y is CH, then R¹ is methyl, ethyl or n-propyl, and with the exception of the case where R¹ is hydrogen, methyl, ethyl or n-propyl, R² is hydrogen or C₁₋₄ alkyl, R³ is -S-R⁴ or

25



30 in which R⁴ is C₁₋₄ alkyl, R⁵ and R⁶ are hydrogen or C₁₋₄ alkyl, Y is CH or N, and Z is 5- or 6-membered heterocyclic group having at least one nitrogen atom which may be substituted by halogen or C₁₋₄ alkyl optionally substituted by halogen.

3) The compounds of the formula (I) according to claim 1 wherein

R¹ is hydrogen, methyl or ethyl,

35 R² is hydrogen, methyl, ethyl, n-propyl, allyl, propargyl, cyclohexyl, phenyl optionally substituted by chlorine, benzyl optionally substituted by chlorine, C₁₋₂ alkoxy or 2-chloro-5-pyridylmethyl,

R³ is

40



45 in which R⁵ and R⁶ are hydrogen, C₁₋₄ alkyl optionally substituted by at least one substituent selected from a group consisting of mercapto, methoxy, cyclohexyl, amino, methylamino, dimethylamino, methoxycarbonyl and cyano, allyl optionally substituted by chlorine, benzyl optionally substituted by chlorine, C₁₋₂ alkoxy, hydroxy, formyl, C₁₋₂ alkylamino, dimethylamino, amino, acetyl, benzoyl, 6-chloronicotinoyl, 2-chloro-5-pyridyl, 2-chloro-5-pyridylmethyl or 2-chloro-5-thiazolylmethyl, in addition R⁵ and R⁶ may represent, together with the adjacent nitrogen atom, pyrrolidino, piperidino, 2-methylpiperidino, morpholino, piperazino or 1-isoxazolyl,

50 Y is CH or N, and

Z is 5-membered heterocyclic group which has one or two nitrogen atoms, or one nitrogen atom and either one oxygen atom or one sulfur atom and may be substituted by halogen or C₁₋₂ alkyl optionally substituted by fluorine, or 6-membered heterocyclic group which has one or two nitrogen atoms and may be substituted by halogen or C₁₋₂ alkyl optionally substituted by fluorine, provided that where Y is CH, then R¹ is methyl or ethyl, and with the exception of the case where R¹ is hydrogen, methyl or ethyl,

55

R² is hydrogen, methyl, ethyl or n-propyl,

R³ is



5 in which R^5 and R^6 are hydrogen or C_{1-4} alkyl, Y is CH or N, and Z is 5- or 6-membered heterocyclic group having at least one nitrogen atom which may be substituted by halogen or C_{1-2} alkyl optionally substituted by fluorine.

4) The compounds of the formula (I) according to claim 1 wherein

R^1 is hydrogen, methyl or ethyl,

10 R^2 is hydrogen, methyl, ethyl, n-propyl, allyl, propargyl, cyclohexyl, phenyl optionally substituted by chlorine, benzyl optionally substituted by chlorine, C_{1-2} alkoxy or 2-chloro-5-pyridylmethyl,

R^3 is



15

in which R^5 and R^6 are hydrogen, C_{1-4} alkyl optionally substituted by at least one substituent selected
20 from a group consisting of mercapto, methoxy, cyclohexyl, amino, methylamino, dimethylamino, methoxycarbonyl and cyano, allyl optionally substituted by chlorine, benzyl optionally substituted by chlorine, C_{1-2} alkoxy, hydroxy, formyl, C_{1-2} alkylamino, dimethylamino, amino, acetyl, benzoyl, 6-chloronicotinoyl, 2-chloro-5-pyridyl, 2-chloro-5-pyridylmethyl or 2-chloro-5-thiazolylmethyl, in addition R^5 and R^6 may represent, together with the adjacent nitrogen atom, pyrrolidino, piperidino 2-methylpiperidino, morpholino,
25 piperazino or 1-isoxazolyl,

Y is CH or N, and

Z is 5-membered heterocyclic group which has one or two nitrogen atoms, or one nitrogen atom and either one oxygen atom or one sulfur atom and may be substituted by halogen or C_{1-2} alkyl optionally substituted by fluorine, or 6-membered heterocyclic group which has one or two nitrogen atoms and may be
30 substituted by halogen or C_{1-2} alkyl optionally substituted by fluorine, provided that where Y is CH, then R^1 is methyl or ethyl, and that where R^2 is hydrogen and R^3 is



35

in which either R^5 or R^6 is hydrogen, the other is allyl, phenyl optionally substituted by chlorine, 2-chloro-5-pyridylmethyl or 2-chloro-5-thiazolylmethyl, then Y is N, and with the exception of the case where R^1 is
40 hydrogen, methyl or ethyl, R^2 is hydrogen, methyl, ethyl or n-propyl, R^3 is



45

in which R^5 and R^6 are hydrogen or C_{1-4} alkyl, Y is CH or N, and Z is 5- or 6-membered heterocyclic group having at least one nitrogen atom which may be substituted by halogen or C_{1-2} alkyl optionally substituted by fluorine.

50 5) The compounds of the formula (I) according to claim 1 wherein

R^1 is hydrogen or methyl

R^2 is hydrogen, methyl, ethyl, allyl, propargyl, methoxy or 2-chloro-5-pyridylmethyl,

R^3 is



55

in which R⁵ and R⁶ are hydrogen, C₁₋₂ alkyl optionally substituted by at least one substituent selected from a group consisting of mercapto, methoxy, cyclohexyl, amino, methylamino, dimethylamino, methoxycarbonyl and cyano, allyl, 2-chloroallyl, benzyl, 3- or 4-chlorobenzyl, methoxy, hydroxy, formyl, methyamino, dimethylamino, amino, acetyl, benzoyl, 6-chloronicotinoyl, 2-chloro-5-pyridyl or 2-chloro-5-

pyridylmethyl,

Y is N, and

Z is 2-chloro-5-pyridyl,

with the exception of the case where R¹ is hydrogen or methyl,

R² is hydrogen, methyl or ethyl,

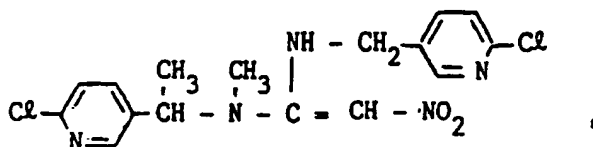
R³ is



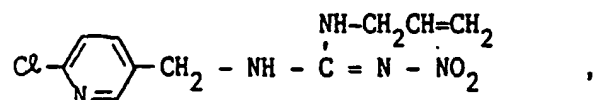
in which R⁵ and R⁶ are hydrogen or C₁₋₂ alkyl, Y is N, and Z is 2-chloro-5-pyridyl.

6) The compounds:

1-{N-[1-(2-chloro-5-pyridyl)ethyl]-N-methylamino}-1-(2-chloro-5-pyridylmethyl)amino-2-nitroethylene represented by the following formula

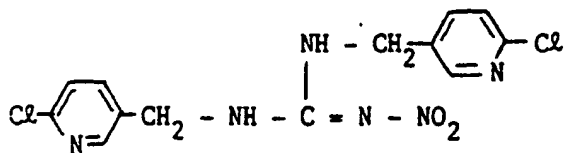


1-allyl-3-(2-chloro-5-pyridylmethyl)-2-nitroguanidine represented by the following formula

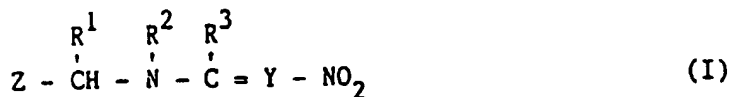


and

1,3-bis-(2-chloro-5-pyridylmethyl)-2-nitroguanidine represented by the following formula



7) Process for the preparation of nitro compounds of the formula (I)



wherein R¹ is hydrogen, cyano or C₁₋₄ alkyl,

R² is hydrogen, C₁₋₆ alkyl, C₃₋₄ alkenyl, C₃₋₄ alkynyl, C₃₋₈ cycloalkyl optionally substituted by C₁₋₂ alkyl,

optionally substituted phenyl, optionally substituted benzyl, C₁₋₄ alkoxy or -(CH₂)_n-Z, in which n is 1 or 2 and

Z has the same meanings as stated hereinafter,

R³ is -O-R⁴, -S-R⁴ or



5 in which R⁴ is C₁₋₆ alkyl, C₃₋₄ alkenyl, C₃₋₄ alkynyl, C₃₋₈ cycloalkyl optionally substituted phenyl, optionally substituted benzyl or -(CH₂)_n-Z,

in which n has the same meanings as stated above and

Z has the same meanings as stated hereinafter,

10 R⁵ and R⁶ are the same or different and stand for hydrogen, C₁₋₉ alkyl optionally substituted by at least one substituent selected from the group consisting of mercapto, C₁₋₂ alkoxy, C₃₋₆ cycloalkyl, amino, C₁₋₂ mono-alkylamino, C₂₋₄ (in total) dialkylamino, C₁₋₂ alkoxy-carbonyl and cyano;

or R⁵ and R⁶ are the same or different and stand for C₃₋₄ alkenyl optionally substituted by halogen, C₃₋₄ alkynyl, optionally substituted phenyl, optionally substituted benzyl, C₁₋₄ alkoxy, hydroxyl, formyl, C₁₋₄ alkylamino, C₂₋₄ (in total) dialkylamino, amino, acyl, 5- or 6-membered heterocyclic group optionally substituted by halogen or C₁₋₄ alkyl, or

15 -CH₂-Z in which Z has the same meanings as stated hereinafter, or

R⁵ and R⁶ may form, together with the adjacent nitrogen atom, 3 to 7 membered cyclic group which may be substituted by C₁₋₂ alkyl and may have N, O or S atom as said ring member, besides the adjacent nitrogen atom,

20 Y is CH or N, and

Z is an optionally substituted 5- or 6-membered heterocyclic group which has at least one hetero atom selected from N, O and S and which may be benzo-fused, provided that where Y is CH,

then R¹ is cyano or C₁₋₄ alkyl, and with the exception of the case where R¹ and R² are hydrogen or C₁₋₄ alkyl, R³ is -S-R⁴ or

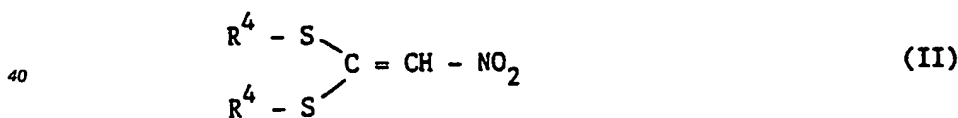


30

in which R⁴ is C₁₋₄ alkyl, R⁵ and R⁶ are hydrogen or C₁₋₄ alkyl, Y is CH or N, and Z is 5- or 6-membered heterocyclic group having at least one nitrogen atom which may be substituted by halogen or C₁₋₄ alkyl. characterised in that

35 a): (in the case where R³ is -S-R⁴ and Y is CH. then R¹ is replaced by R⁷, in which R⁷ is cyano or C₁₋₄ alkyl)

compounds of the formula (II)



40

wherein R⁴ has the same meaning as mentioned above,

45 are reacted with compounds of the formula (III)



50

wherein R⁷, R² and Z have the same meanings as stated above,

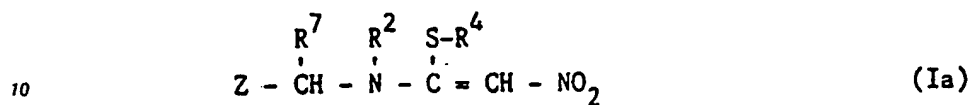
in the presence of inert solvents,

or

55 b): (in the case where R³ is



5 and Y is CH, then R¹ is replaced by R⁷)



wherein R⁷, R², R⁴ and Z have the same meanings as mentioned above,
are reacted with compounds of the formula (IV)



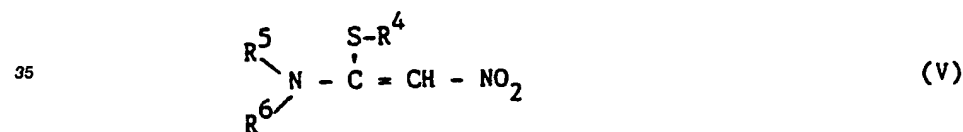
20 wherein R⁵ and R⁶ have the same meanings as mentioned above,
in the presence of inert solvents,

or

c): (in the case where R³ is



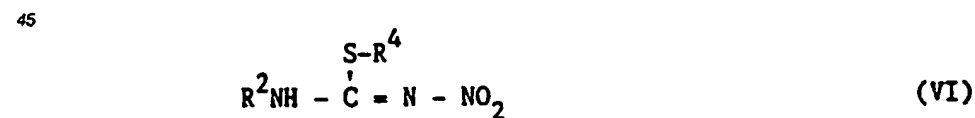
30 and Y is CH)
compounds of the formula (V)



40 wherein R⁴, R⁵ and R⁶ have the same meanings as mentioned above,
are reacted with the aforementioned compounds of the formula (III) in the presence of inert solvents,

or

d): (in the case where R³ is -S-R⁴ and Y is N)
compounds of the formula (VI)



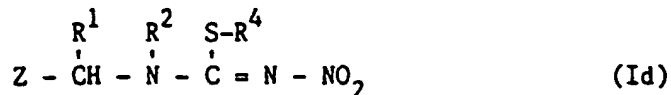
50 wherein R² and R⁴ have the same meanings as mentioned above,
are reacted with compounds of the formula (VII)



wherein R¹ and Z have the same meanings as mentioned above,
and M is halogen, methanesulfonyloxy or tosyloxy,
in the presence of inert solvents, and if appropriate in the presence of acid binders,
or

e): (in the case where R³ is $\overset{\text{R}^5}{\underset{|}{\text{N}}}-\text{R}^6$ and Y is N)

compounds of the formula (Id)



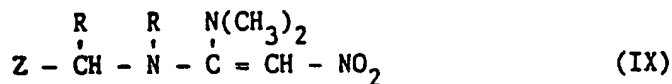
wherein R¹, R², R⁴ and Z have the same meanings as mentioned above,
are reacted with the aforementioned compounds of the formula (IV) in the presence of inert solvents,
or

f): (in the case where R³ is $-\text{O}-\text{R}^4$ and Y is N)
compounds of the formula (VIII)



wherein R¹, R², R⁴, Z and M have the same meanings as mentioned above,
are reacted with fuming nitric acid in the presence of concentrated sulfuric acid, and if appropriate in the
presence of inert solvents,
or

g): (in the case where R³ is $-\text{O}-\text{R}^4$ and Y is CH, then R¹ is replaced by R⁷)
compounds of the formula (IX)



wherein R⁷, R² and Z have the same meanings as mentioned above,
are reacted with compounds of the formula (X)



wherein R⁴ has the same meaning as mentioned above,
in the presence of inert solvents.

8) Insecticidal compositions, characterised in that they contain at least one nitro compound of the formula (I).

9) Process for combating harmful insects, characterised in that nitro compounds of the formula (I) are allowed to act on harmful insects and/or their habitat.

10) Use of nitro compounds of the formula (I) for combating harmful insects.

11) Process for the preparation of insecticidal compositions, characterised in that nitro compounds of the formula (I) are mixed with extenders and/or surface-active agents.



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 10 1858

| DOCUMENTS CONSIDERED TO BE RELEVANT | | | |
|---|---|--|--|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int. Cl.5) |
| A, D | EP-A-0 302 389 (TAKEDA CHEMICAL INDUSTRIES LTD.) * Page 52, example 22, compound 40 * --- | 1, 7-10 | C 07 D 213/61 A 01 N 47/44 C 07 D 333/28 |
| A | EP-A-0 163 855 (NIHON TOKUSHU NOYAKA SEIZO K.K.) * Claims * --- | 1 | |
| A | EP-A-0 104 423 (BAYER AG) * Whole document * & US-A-45 67 188 (Cat. D) ----- | 1 | |
| | | | TECHNICAL FIELDS SEARCHED (Int. Cl.5) |
| | | | C 07 D 213/00 |
| The present search report has been drawn up for all claims | | | |
| Place of search THE HAGUE | | Date of completion of the search 27-02-1990 | Examiner DE JONG B.S. |
| CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons A : member of the same patent family, corresponding document | | | |